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(54) Title: SYSTEM AND METHOD FOR BACKLIGHTING CONTROL IN A WIRELESS COMMUNICATION DEVICE
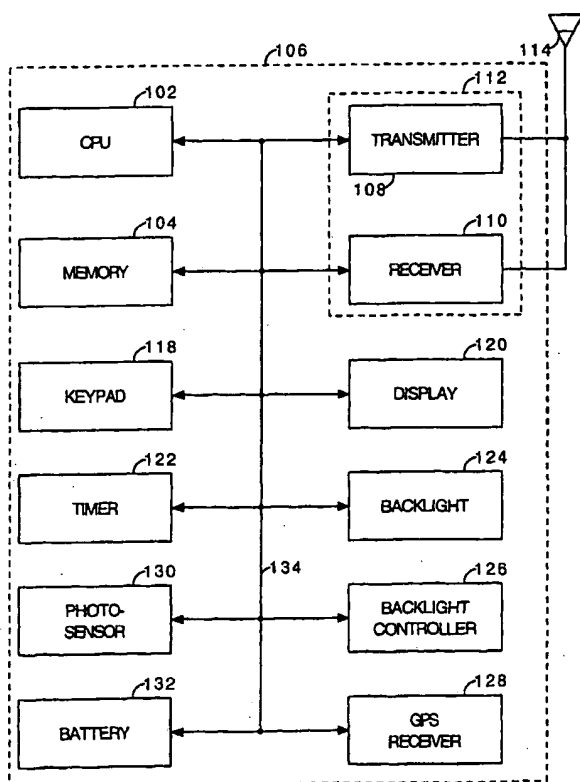
(57) Abstract: A wireless communication device (100) includes a display (120) having a backlight (124). A backlight controller (126) selectively enables the backlight (124) to minimize power consumption and conserve energy in a battery (132). In one embodiment, a receiver (110) receives a time-of-day message from a remote location to set a timer (122) with the current time-of-day. The current time-of-day is compared with a predetermined time-of-day and the backlight controller (126) enables and disables the backlight (124) at predetermined times-of-day. The wireless communication device (100) may also include a GPS receiver (128), to determine the location of the device. The backlight controller (126) can determine the sunrise or sunset times for the specific location. The GPS data may be used in combination with the time-of-day message. A photosensor (130) can detect ambient light levels and generate an electrical signal corresponding thereto. The backlight controller (126) may use the photosensor (130) to determine ambient light levels and to enable or disable the backlight (124) based only on ambient light levels. The photosensor signal can be used in combination with the time-of-day message and/or the location data from the GPS receiver (128) to control the backlight (124).

# SYSTEM AND METHOD FOR BACKLIGHTING CONTROL IN A WIRELESS COMMUNICATION DEVICE

## FIELD OF THE INVENTION

The present invention is directed generally to a wireless communication device, and, more particularly, to a system and method for controlling backlighting in a wireless communication device.

## BACKGROUND OF THE INVENTION

Wireless communication devices, such as cellular telephones, typically include a keypad and a display. The display may include several lines of alphanumeric characters that provide the user with instructions for operation of the device, feedback in response to user activation of selected buttons on the keypad, and other data display, such as data related to an incoming call.

A common display type uses a liquid crystal display (LCD) because of its low-cost, readability, and low power consumption. A disadvantage of an LCD is that it has poor readability with low ambient light levels. The typical LCD includes a backlight to light the display and thereby enhance readability. The backlight, which is typically an incandescent light, consumes far more electrical power than the LCD itself.

The typical wireless communication device is battery-powered. Conservation of battery power is important to increase the operating duration of the device. Activating the backlight for the LCD display consumes a significant amount of battery power and therefore decreases the operating time of the device. Therefore, it can be appreciated that there is a significant need for wireless communication device that provides backlighting for enhanced readability and conserves battery power. The present invention provides this and other advantages as will be apparent from the following detailed description and accompanying figures.

2

## SUMMARY OF THE INVENTION

The present invention is embodied in a system and method for controlling a display light in a wireless communication device. In one embodiment, the system includes a receiver that receives communication signals from a location remote from the receiver. The system also includes a display and a display light that may be selectively enabled by an enable signal. A light controller generates the enable signal based at least in part on signals received by the receiver.

In one embodiment, the receiver receives a time-of-day signal from the remote location and the light controller generates the enable signal based on the time of day. The system may further include a photosensor element to sense ambient light and to generate a signal related to the level of ambient light. In this embodiment, the light controller generates the enable signal based on the time of day and on the level of ambient light. The light controller may generate the enable signal based on the time of day for a first predetermined portion of the day and based on the level of ambient light for the remaining portion of the day.

In another embodiment, the receiver receives positioning signals from the remote location and the light controller generates the enable signals based on the location of the receiver. This embodiment may also include a photosensor element such that the light controller generates the enable signal based on the location of the receiver and on the ambient light.

In yet another alternative embodiment, the light controller may generate the enable signal based solely on the ambient level of light and the signal generated by the photosensor element. If the ambient level of light drops below a predetermined threshold, the light controller may generate the enable signal and ceases generation of the enable signal if the ambient light level is above a second predetermined threshold.

3

# BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a functional block diagram of a wireless communication device implementing the present invention.

FIG. 2 illustrates the operation of the system of FIG. 1 using data received
5    from external sources.

FIG. 3 is a flowchart illustrating the operation of the system of FIG. 1 to selectively enabling backlight based on the time-of-day.

FIG. 4 is a flowchart illustrating the operation of the system of FIG. 1 to selectively enabling backlight based on the geographic location of the system.

10   # DETAILED DESCRIPTION OF THE PREFERRED
# EMBODIMENTS

The present invention provides intelligent control of backlighting and, as a result, reduces battery drain.   The present invention may be readily
15   implemented in any wireless communication device.   Although the examples pressured herein refer to a cellular telephone, the principles of the present invention are applicable to any wireless communication device, including, but not limited to, analog and digital cellular telephones, personal communications system (PCS) devices, and the like.   The present invention is embodied in a
20   system 100 illustrated in the functional block diagram of FIG. 1.   The system 100 includes a central processing unit (CPU) 102, which controls operation of the system.   A memory 104, which may include both read-only memory (ROM) and random access memories (RAM), provides instructions and data to the CPU 102.   A portion of the memory 104 they also include non-volatile random access
25   memory.

The system 100, which is typically embodied in a wireless communication device such as cellular telephone, also includes a housing 106 that contains a transmitter 108 and a receiver 110 to allow transmission and reception of data, such as audio communications, between the system 100 and a
30   remote location, such as a cell site controller (not shown).   The transmitter 108 in the receiver 110  may be combined into a transceiver 112.   An antenna 114 is attached to the housing 106 and electrically coupled to the transceiver 112.   The

4

operation of the transmitter **108**, receiver **110**, and antenna **114** is well-known in the art in need not be described herein. Although FIG. 1 illustrates the antenna **114** is extending from the housing **106**, some designs may include an internal antenna that is contained completely within the housing. However, the

5    transmitter **108**, receiver **110**, and antenna **114** operate in a conventional manner regardless of the location of the antenna.

A keypad **118** is attached to the housing **106** for operation by the user in a conventional manner. The keypad **118** provides a convenient input device by which destination telephone numbers and commands may be entered by the

10   user.

The system **100** also includes a display **120** that may be conveniently used to display instructions to the user as well as user-entered data, such as destination telephone numbers and alphanumeric text. In an exemplary embodiment of the system **100**, the display **120** will display the time and date

15   and calling party telephone number for incoming calls received by the transceiver **112**. This information provides visual cues to the user and thereby assists the user in the operation of the system **100**.

The system **100** also includes a timer **122**, which may typically be included in the CPU **102**. As will be discussed in greater detail below, system

20   **100** may use the timer **122** to determine the time and date. In addition, the timer **122** may be used to light a backlight **124** for a predetermined period of time. The system **100** includes a backlight controller **126** to control the backlight **124** for the display **120**. As will be described in greater detail below, various alternative embodiments of the backlight controller **126** may be used control the

25   backlight **124** and thereby reduce power consumption in the system **100**. In addition, different display types may use a different form of lighting, such as side-lighting of a liquid crystal display (LCD) or a light-emitting diode (LED) display. The term "backlight" is intended to encompass any form of display illumination whether it is the display itself or an external illumination source.

30   In one embodiment, the system **100** includes a global positioning system (GPS) receiver **128**. As is known in the art, GPS comprises a plurality of satellites orbiting the Earth. A GPS receiver, such as the GPS receiver **128**, receives signals from some of the plurality of the orbiting satellites. Based on

the received signals, it is possible to determine the precise location of the GPS receiver **128** with a high degree of accuracy. Portable GPS receivers are known in the art, and need not be described in greater detail herein. If the system **100** includes the GPS receiver **128**, the position of the system may be used by the

5 backlight controller **126** to enable the backlight **124**. The use of the GPS receiver **128** in the backlight controller **126** will be described in greater detail below.

In one embodiment, the system **100** includes a photosensor **130**, which detects ambient light levels and generates electrical signals related thereto. As will be described in greater detail below, the backlight controller **126** receives

10 the electrical signals from the photosensor **130** and may selectively activate the backlight **124** when the ambient light falls below a predetermined level.

Electrical components of the system **100** receive power from a battery **132**, which is attached to and supported by the housing **106**. In exemplary embodiment, the battery **132** is a rechargeable battery. In other embodiments,

15 the system **100** may include a connector (not shown) for the connection of an external power source, such as an automobile power adapter, AC power adapter, or the like.

The various components of the system **100** are coupled together by a bus system **134**, which may include a power bus, control bus, and status signal bus

20 in addition to a data bus. However, for the sake of clarity, the various buses are illustrated in FIG 1. as the bus system **134**.

The backlight controller **126** may be implemented in a variety of ways. In one embodiment, illustrated in FIG. 2, the timer **122** receives a time-of-day message from a base transceiver station (BTS) **150** via a cell site controller (not

25 shown). The time-of-day message is used to set the timer **122** or a clock whose time is shown on the display **120**. The techniques used to transmit the time-of-day message to the system **100** are well-known in the art and the need not be described in greater detail herein.

The backlight controller **126** uses the time-of-day to selectively enable or

30 disable the backlight **124** during predetermined times of day. For example, the backlight controller **126** may be programmed to enable the backlight **124** between the hours of 7 p.m. and 7 a.m.. During this predetermined period of time, the backlight controller **126** will selectively enable the backlight **124**

6

whenever a button on the keypad **118** is activated by the user. In addition, the system **100** may enable the backlight **124** when receiving an incoming telephone call. Outside the predetermined hours (*e.g.,* between the hours of 7 a.m. and 7 p.m.), the backlight controller **126** will not enable the backlight **124** even when a

5    button on the keypad **118** is activated by the user or when incoming message is received by the system **100**. Those skilled in the art will appreciate that the hours of activation used above are illustrative only and that the present invention is not limited by specific hours of operation of the backlight **124**. The user can program the hours of activation using the keypad **118** and display **120**

10   in the same manner used to select other operational parameters of a typical cellular telephone.

One advantage of implementing the system **100** with the time-of-day message is that most wireless communication devices (*e.g.,* cellular and PCS devices) are already configured to receive the time-of-day message. The

15   backlight controller **126** may be readily implemented as a series of software instructions placed in the memory **104** and executed by the CPU **102**. Thus, minor software modifications to existing hardware will allow the implementation of the system **100** using the time-of-day message.

The backlight controller **126** may also use location information to enable

20   the backlight **124**. As previously described, the system **100** may include GPS receiver **128**, which operates in a known manner to receive signals from a plurality of GPS satellites, one of which is illustrated in FIG. 2 as a GPS satellites **152**. For the sake of clarity, other GPS satellites are not illustrated in FIG. 2. Given the precise location of the system **100**, the backlight controller **126** can

25   determine the precise time of sunset at that location. The backlight controller **126** selectively enables the backlight **124** at sunset for the location of the system **100** and selectively disables the backlight **124** at sunrise for the location of the system.

Those skilled in the art will appreciate that ambient light levels may be

30   insufficient for satisfactory operation of the system **100** before sunset or after sunrise. Accordingly, the backlight controller **126** can selectively enable the backlight **124** a predetermined period of time before sunset and selectively disable the backlight **124** it predetermined period of time after sunrise to allow

for satisfactory operation in low ambient light. The present invention is not limited by the specific time-of-day at which the backlight 124 is selectively enabled or disabled.

The GPS receiver 128 may be used in combination with the time-of-day
5    message transmitted by the BTS 150. In this embodiment, the backlight controller 126 uses the time-of-day message to determine the local time and uses the location data from the GPS receiver 128 to determine the precise location of the system 100 and thereby determine the time of sunrise and sunset at that precise location. If the wireless communication device already includes the GPS
10   receiver 128, the backlight controller 126 may be readily implemented as a series of software instructions that utilize that location data generated by the GPS receiver alone or in combination with time-of-day message.

One drawback of these embodiments is that it presumes that ambient light is always available during daytime hours and is never available during the
15   nighttime hours. However, it is possible that the user could enter a darkened room during daylight hours. In this circumstance, the backlight controller 126 may not operate satisfactorily since the backlight 124 is selectively disabled during daylight hours. Similarly, the backlight controller 126 may selectively enable the backlight 124 during nighttime hours even when the user is a lighted
20   room. Although this latter example does not affect the user's ability to operate the system 100, it does not provide the desired reduction in power consumption and reduces the life of the battery 132 (see FIG. 1) between charging cycles. The system 100 can provide an override command to allow the user to manually enable or disable the backlight 124. The use of the keypad 118 to set the
25   operational parameters of the system 100 is well-known in the art and need not be described herein.

The system 100 may also use the photosensor 130 alone or in combination with time-of-day message from the BTS 150 and/or the location data from the GPS receiver 128. If the photosensor 130 is used alone, the
30   backlight controller 126 receives the electrical signals generated by the photosensor that indicate the ambient light level. If the ambient light level falls below a predetermined threshold, the backlight controller 126 selectively enables the backlight 124. As those skilled in the art will appreciate, actual

8

activation of the backlight **124** occurs when the keypad **118** is activated by the user or when an incoming message is received. If the ambient light level is above a predetermined threshold, the backlight controller **126** will selectively disable the backlight **124**.

5      When used in combination with the time-of-day message, the electrical signals generated by the photosensor **130** are used to effectively override the normal setting provide by the time-of-day message. For example, backlight controller **126** may selectively disable the backlight **124** based on the time-of-day message (*e.g.*, during daylight hours). However, if user enters a darkened

10    room or is in some other low ambient light setting, the electrical signals generated by the photosensor **130** indicate that the ambient light level is below a predetermined threshold. In that event, the backlight controller **126** overrides the setting based on the time-of-day message and selectively enables the backlight **124** to automatically provide backlighting when necessary.

15    Similarly, the backlight controller may selectively enabled the backlight **124** based on the time-of-day message (*e.g.*, during nighttime hours). However, if the user enters a lighted room or is in some other high ambient light setting, the electrical signals generated by the photosensor **130** indicate that the ambient light level is above a predetermined threshold. In that event, the backlight

20    controller **126** overrides the setting based on the time-of-day message and selectively disables the backlight **124** thus conserving power and extending the life of the battery **132** between charging cycles.

The photosensor **130** may also operate in conjunction with the GPS receiver **128** in a similar manner to override the normal setting based on the

25    location data generated by the GPS receiver. That is, the backlight controller **126** may use the electrical signals generated by the photosensor **130** to selectively enable or disable the backlight **124** regardless of the setting based on the location data generated by the GPS receiver **128**.

The operation of the system **100** with the time-of-day message is

30    illustrated in the flowchart of FIG. 3. At a start 160, the wireless communication device is under power. In step 162, the system **100** receives a time-of-day message from the BTS **150** (see FIG. 2). In step 164, the system **100** sets its internal clock. It should be noted that the timer **122** (see FIG. 1) also serves the

9

function of the internal clock. Those skilled in the art will appreciate that the timer **122** may be contained within the CPU **102**. The present invention is not limited by the specific form of the timer **122**.

5      In decision **166**, the system **100** determines whether it is nighttime. The specific times at which the backlight **124** is selectively enabled and disabled can be preprogrammed into the system **100** or selected by the user. For example, the system **100** can have default times, such as at 7 p.m. and 7 a.m., to selectively enable and disable the backlight **124**. Alternatively, the user may alter the default times through the selection of the appropriate menu on the

10  display **120** with the keypad **118** using conventional techniques. For example, if the user lives in higher latitudes, where summertime days are long and a wintertime days are short, the user can manually adjust the default times to compensate for seasonal variations in the length of days.

     The actual time of day is compared with predetermined hours of

15  backlight operation (*i.e.*, either the default times or the user-programmed times). Decision **166** compares the present time with the predetermined times to determine whether or not to enable the backlight **124**. If it is nighttime (*e.g.*, between 7 p.m. and 7 a.m., the result of decision **166** is YES. In that event, the backlight controller **126** selectively enables the backlight **124** in step 168. If it is

20  not nighttime, the result of decision **166** is NO. In that event, the backlight controller **126** selectively disables the backlight **124** in step 170.

     As previously discussed, the photosensor **130** (see FIG. 1) can be used to override the setting based on the time-of-day. Decisions **174** and **176** are optional steps that can be incorporated into the system **100** if the photosensor

25  **130** is included. In FIG. 3, the ambient light level is compared with a threshold value in decision 174. If the ambient light level is below the threshold, the result of decision 174 is YES and the system **100** moves to step 168 to enable the backlight **124** despite the fact that it is not yet nighttime (*i.e.*, the result of decision 166 was NO).

30      Similarly, in decision 176, the system **100** determines whether the ambient light level is above a predetermined threshold. For the sake of convenience, the ambient light level thresholds used in the decision 174 and 176 may be the same light threshold. However, this is not required for satisfactory

operation of the system **100**. That is, the system **100** may use a first threshold in decision 174 and a second threshold, different from the first threshold, in decision 176. If the ambient light level is above the predetermined threshold, the result of decision 176 is YES. In that event, the system **100** moves to step 170

5   to disable the backlight **124** despite the fact that it is nighttime (*i.e.*, the result of decision 166 was YES).

In decision 180, the system **100** determines whether it the user has activated keypad **118** (see FIG. 1). If the user has activated the keypad **118**, the result of decision 180 is YES. In that event, in step 184 the backlight controller

10  **126** activates the backlight **124** if the backlight has been enabled and does nothing in step 184 if the backlight is disabled. The system ends the operation at step 188. If no activation of the keypad occurs, the result of decision 180 is NO. In that event, the system **100** returns to decision 180 to await subsequent activation of the keypad **118**. For purposes of understanding the present

15  invention, the system **100** is illustrated in the flowchart of FIG. 3 as sitting in a loop at decision 180 awaiting activation of the keypad **118**. However, those skilled in the art will recognize that keypad activation may generate an interrupt that is processed by the CPU **102**. Thus, in a typical implementation, the system **100** does not sit in an endless loop awaiting activation of the keypad

20  **118**. In addition, the backlight **124** may be activated in step **184** if the receiver **110** (see FIG. 1) receives an incoming call. Other events, such as voicemail notification and the like can also trigger activation of the backlight **124** if it has been selectively enabled. Thus, keypad activation is not the only event that can trigger activation of the backlight **124**.

25  The operation of the system **100** with the GPS receiver **128** (see FIG. 1) is illustrated in the flowchart of FIG. 4. At a start 200, the system **100** is under power. At step 202, the GPS receiver **128** receives GPS data from a plurality of GPS satellites **152** (see FIG. 2) and determines the location of the system **100** in step 204. In step 206, the system **100** determines the sunrise and the sunset

30  times for the location determined in step 204. The system **100** then moves to decision 166, illustrated in FIG. 3, to determine whether the present time-of-day corresponds with the sunrise and/or sunset times calculated in step 206. The remaining operations, including the use of ambient light levels to override the

11

operation of step 168 to enable the backlight **124** or the operation of the step 170 to disable the backlight, have been described above and need not be described again at this point.

Thus, the system **100** advantageously provides an intelligent control of
5   the backlight **124** and thereby conserves the electrical power. In several embodiments, the invention may be readily implemented through the addition of software instructions alone and require no hardware modifications. For wireless communication devices that include GPS capability, the invention may also be implemented with the addition of software instructions. It should be
10   noted that other forms of positioning, such as triangulation, timing signals from a plurality of base station transceiver systems **150** (see FIG. 2) or other conventional positioning technology may be satisfactorily used with the system **100**. One advantage of positioning data is that the lighting may be adjusted to compensate for variations in the length of day based on the location of the
15   wireless communication device.

Is to be understood that even though various embodiments in advantages of the present invention have been set forth in the foregoing description, the above disclosure is illustrative only, and changes may be made in detail, yet remain within the broad principles of the invention. For example,
20   the system 100 may be implemented using only the time-of-day message, the location data from the GPS receiver 128, or the electrical signals generated by the photosensor 130 to control operation of the backlight 124. However, these various techniques they be combined in various manners to meet different design criteria. Therefore, the present invention is to be limited only by the
25   appended claims.

**What is claimed is:**

12

# CLAIMS

1. A system for the control of backlighting in a wireless
2 communication device, the system comprising:

a housing;

4 a receiver to receive communication signals from a location remote from
the receiver;

6 a display supported by the housing;

a display light to light the display, the display light being selectively
8 enabled by an enable signal; and

a light controller to generate the enable signal based at least in part on
10 signals received by the receiver.

2. The system of claim 1, further comprising a timer to track time of
2 day wherein the light controller generates the enable signal based on the time of
day.

3. The system of claim 2 wherein the receiver receives time-of-day
2 signals from the remote location and the timer uses the time-of-day signals to
track the time of day.

4. The system of claim 2, further comprising a photosensor element
2 supported by the housing to sense ambient light and to generate a signal related
to the level of ambient light wherein the light controller generates the enable
4 signal based on the time of day and on the level of ambient light.

5. The system of claim 2, further comprising a photosensor element
2 supported by the housing to sense ambient light and to generate a signal related
to the level of ambient light wherein the light controller generates the enable
4 signal based on the time of day for a first predetermined portion of the day and
on the level of ambient light for the remaining portion of the day.

13

6.    The system of claim 1 wherein the light controller activates the
2    display light when the receiver receives an incoming message if the enable
      signal has been generated.

7.    The system of claim 6, further comprising a keyboard operable by
2    a user wherein the light controller activates the display light when the keyboard
      is operated by the user if the enable signal has been generated.

8.    The system of claim 7, further comprising a timer to measure a
2    predetermined time period when the keyboard is operated by the user wherein
      the light controller deactivates the display light if the keyboard is not operated
4    by the user for the predetermined time period.

9.    The system of claim 8 wherein the predetermined time period
2    measured by the timer is user-selectable.

10.   The system of claim 1 wherein the receiver receives location
2    signals from the remote location and thereby determines a location of the
      receiver, the light controller generating the enable signal based on the location
4    of the receiver.

11.   The system of claim 10 wherein the remote location is at least a
2    first satellite and the location signals from the remote location comprises global
      positioning satellite signals.

12.   The system of claim 10, further comprising a timer to track time of
2    day wherein the light controller generates the enable signal based on the time of
      day and the location of the receiver.

13.   The system of claim 12 wherein the receiver receives a time-of-day
2    message from the remote location, the timer receiving and utilizing the time-of-
      day message to track time of day.

14

14.    The system of claim 10, further comprising a photosensor element
2   to sense ambient light and to generate a signal related thereto, the light
controller generating the enable signal based on the location of the receiver and
4   on the level of ambient light.

15.    The system of claim 14, further comprising a timer to track time of
2   day wherein the light controller generates the enable signal based on the time of
day, the location of the receiver and on the level of ambient light.

16.    A system for the control of backlighting in a wireless
2   communication device, the system comprising:
a housing;
4       a transceiver to transmit communication signals to and receive
communication signals from a location remote from the transceiver;
6       a photosensor element to sense an ambient light level and to generate a
signal related thereto;
8       a display supported by the housing;
a display light to light the display, the display light being selectively
10   enabled by an enable signal; and
a light controller to receive the signal generated by the photosensor
12   element and to generate the enable signal based the ambient light level.

17.    The system of claim 16 wherein the light controller generates the
2   enable signal if the signal from the photosensor indicates that the level of
ambient light is below a predetermined threshold.

18.    The system of claim 16 wherein the light controller activates the
2   display light when the transceiver receives an incoming message if the enable
signal has been generated.

19.    The system of claim 16, further comprising a keyboard operable
2   by a user wherein the light controller activates the display light when the
keyboard is operated by the user if the enable signal has been generated.

20.     The system of claim 19, further comprising a timer to measure a

2   predetermined time period when the keyboard is operated by the user wherein
the light controller deactivates the display light if the keyboard is not operated

4   by the user for the predetermined time period.


21.     The system of claim 20 wherein the predetermined time period

2   measured by the timer is user-selectable.


22.     The system of claim 16, further comprising a timer to track time of

2   day wherein the light controller generates the enable signal based on the time of
day and the ambient light level.


23.     The system of claim 22 wherein the transceiver receives time-of-

2   day signals from the remote location and the timer uses the time-of-day signals
to track the time of day.


24.     The system of claim 22 wherein the light controller generates the

2   enable signal based on the ambient light level if the signal from the photosensor
indicates that the level of ambient light is below a predetermined threshold

4   regardless of the time of day.


25.     The system of claim 16 wherein the transceiver receives location

2   signals from the remote location and thereby determines a location of the
receiver, the light controller generating the enable signal based on the location

4   of the receiver and the ambient light level.


26.     A method for the control of backlighting in a wireless

2   communication device, the method comprising:
receiving signals for use in controlling display lighting;

4           displaying data on a display; and
selectively enabling a display light to light the display based the received

6   signals.

27.    The method of claim 26, further comprising sensing an ambient

2   light level and generating a signal related thereto, the received signals to control

display lighting being the generated signal related to the ambient light level, the

4   display light being selectively enabled if the generated signal related to the

ambient light level indicates that the ambient light level is below a

6   predetermined threshold.

28.    The method of claim 27, further comprising measuring a time of

2   day and selectively enabling the display light based on the time of day and the

ambient light level.

29.    The method of claim 28 wherein the display light is selectively

2   enabled signal based on the ambient light level if the generated signal related to

the ambient light level indicates that the level of ambient light is below a

4   predetermined threshold regardless of the time of day.

30.    The method of claim 26, further comprising receiving an incoming

2   message from a remote location and activating the display light upon receipt of

the incoming message if the display light has been selectively enabled.

31.    The method of claim 26, further comprising sensing user operation

2   of a keyboard and activating the display light when the keyboard is operated by

the user if the display light has been selectively enabled.

32.    The method of claim 31, further comprising measuring a

2   predetermined time period when the keyboard is operated by the user and

deactivating the display light if the keyboard is not operated by the user for the

4   predetermined time period.

33.    The method of claim 26, further comprising measuring a time of

2   day and generating a signal related thereto, the received signals to control

display lighting being the generated signal related to the time of day, the

4   display light being selectively enabled based on the time of day.


34.   The method of claim 26, further comprising receiving an incoming

2   time of day message from a remote location and generating a signal related

thereto, the received signals to control display lighting being the generated

4   signal related to the received time of day message, the display light being

selectively enabled based on the time of day.


35.   The method of claim 26, further comprising receiving location

2   signals from a remote location and determining a location related thereto, the

received signals to control display lighting being the generated signal related to

4   the location, the display light being selectively enabled based on the location.


36.   The method of claim 35 wherein the remote location is at least a

2   first satellite and receiving location signals from the remote location comprises
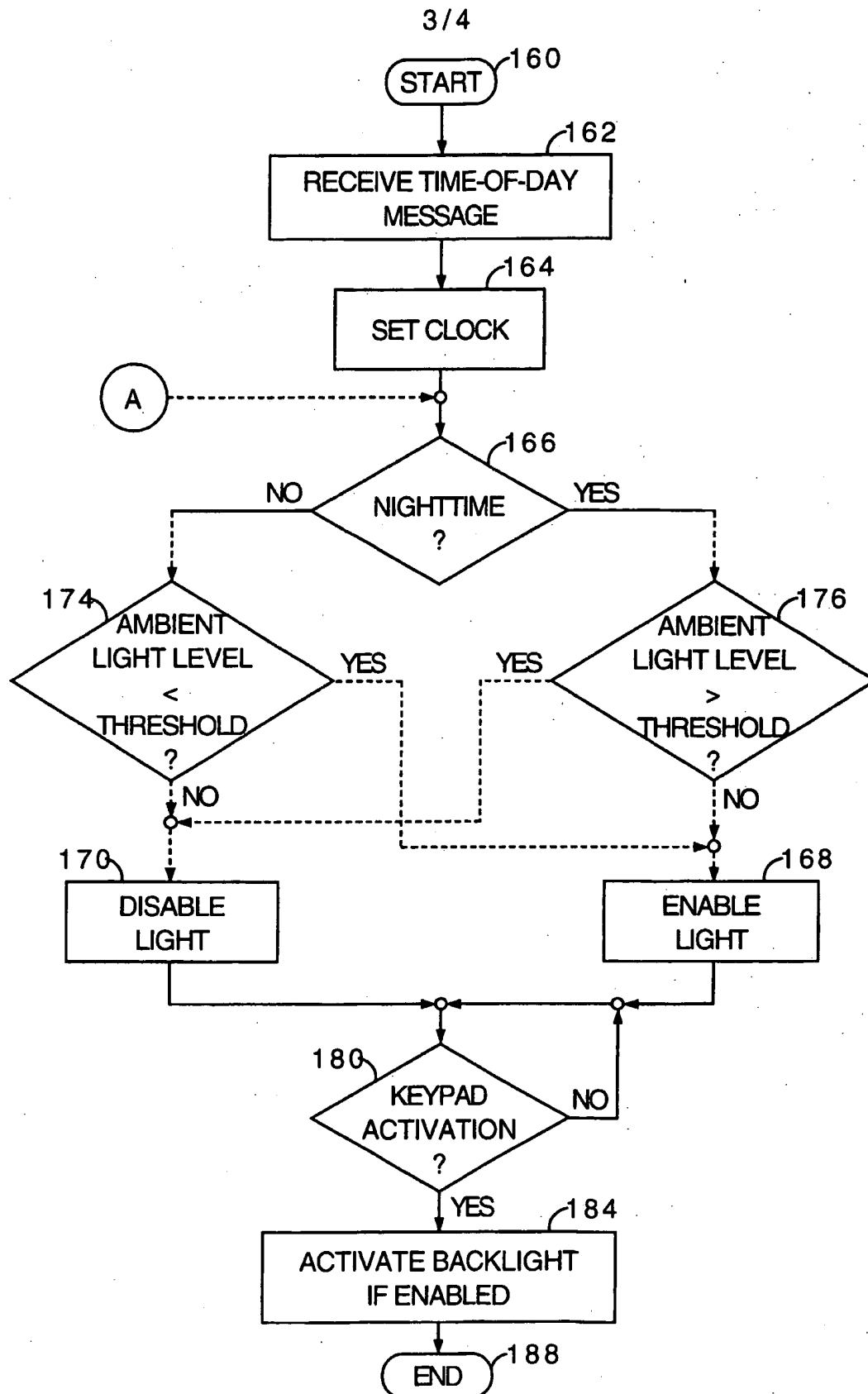
receiving satellite signals.
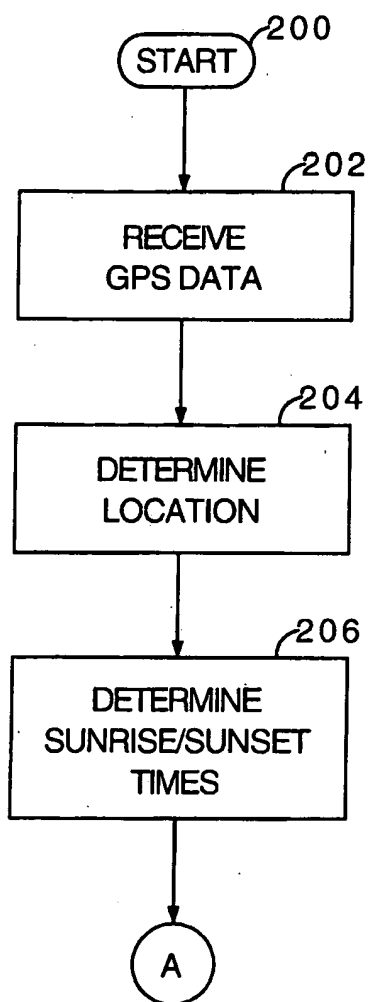
1 / 4
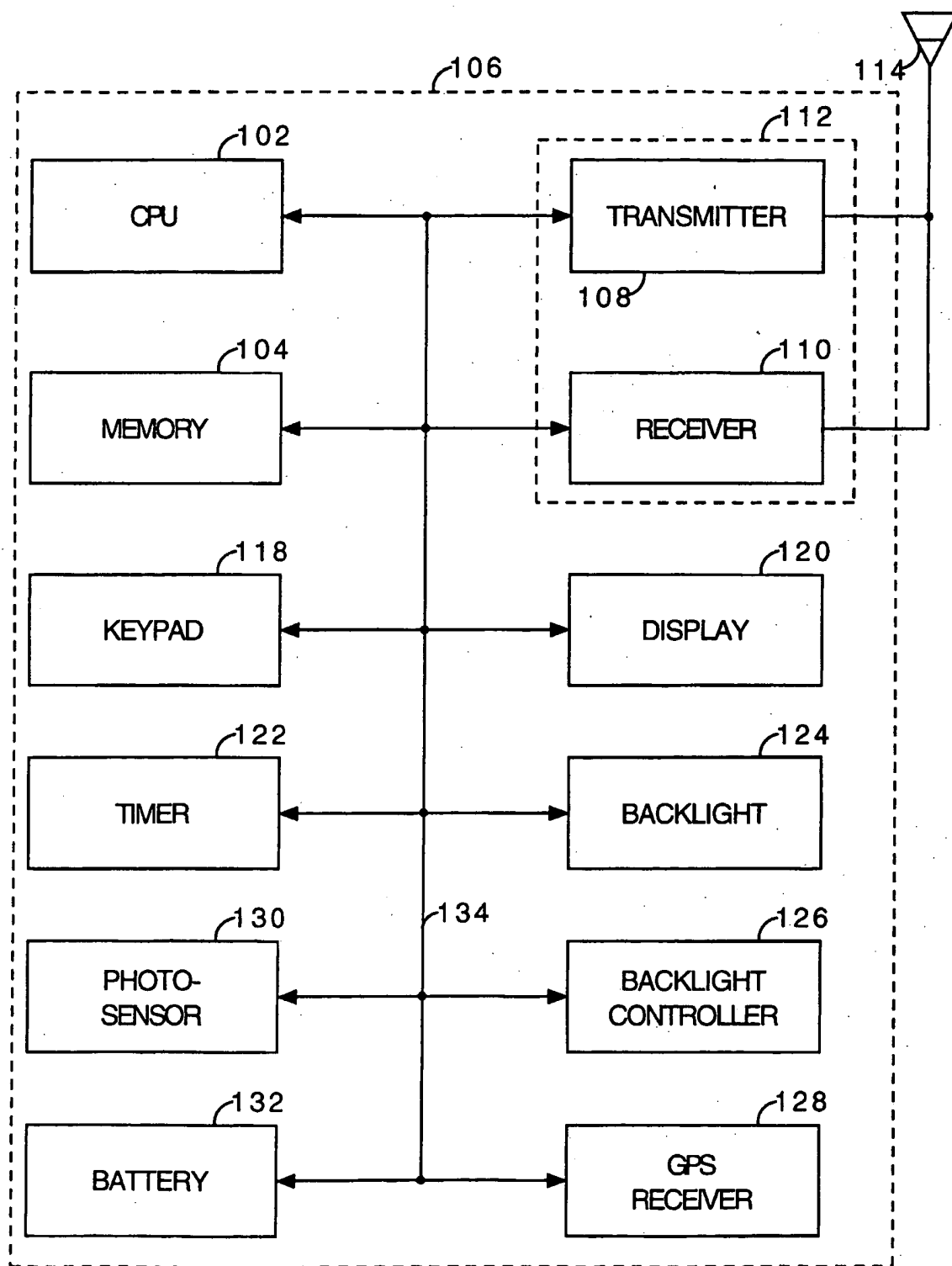


FIG. 1
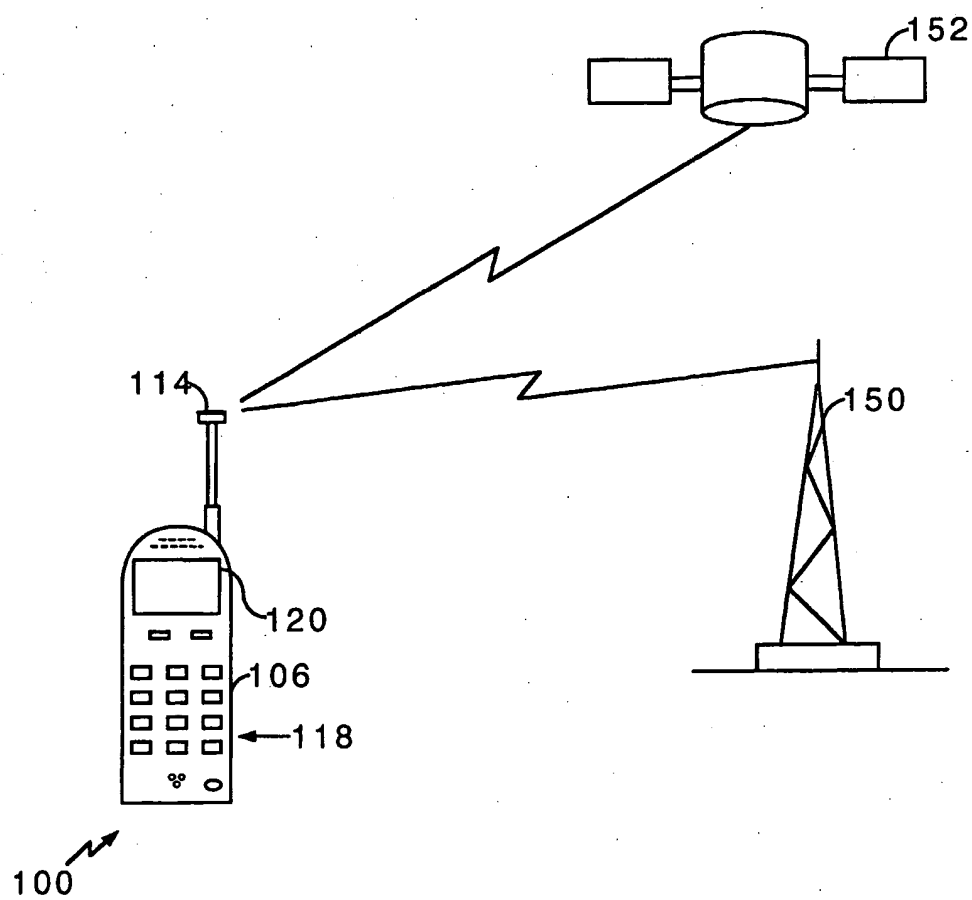
FIG. 2

FIG. 3

4 / 4

```
         ┌─────────┐ ⟋200
         ( START  )
         └─────────┘
              │
              ▼         ⟋202
     ┌──────────────────┐
     │     RECEIVE       │
     │    GPS DATA       │
     └──────────────────┘
              │
              ▼         ⟋204
     ┌──────────────────┐
     │    DETERMINE      │
     │    LOCATION       │
     └──────────────────┘
              │
              ▼         ⟋206
     ┌──────────────────┐
     │    DETERMINE      │
     │  SUNRISE/SUNSET   │
     │     TIMES         │
     └──────────────────┘
              │
              ▼
            ( A )
```

FIG. 4

## A. CLASSIFICATION OF SUBJECT MATTER
IPC 7   H04M1/22

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7   H04M   G09G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, INSPEC, COMPENDEX

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

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| X | Further documents are listed in the continuation of box C. | | X | Patent family members are listed in annex. |

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"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 16 May 2001 | 28/05/2001 |

| Name and mailing address of the ISA | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016 | Vaucois, X |

Form PCT/ISA/210 (second sheet) (July 1992)

| C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT | | |
|---|---|---|
| Category ° | Citation of document, with indication,where appropriate, of the relevant passages | Relevant to claim No. |
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